

# The Potential for PTSD, Substance Use, and HIV Risk Behavior among Adolescents Exposed to Hurricane Katrina

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*Adverse psychosocial outcomes can be anticipated among youth exposed to Hurricane Katrina. Adolescents are particularly vulnerable to the consequences of this natural disaster and may suffer lasting consequences in the form of psychological morbidity and the development of negative health behaviors due to their exposure. We review existing literature on the effects of exposure to natural disasters and similar traumas on youth and, where data on youth are unavailable, on adults. The effect of natural disasters is discussed in terms of risk for three negative health outcomes that are of particular concern due to their potential to cause long-term morbidity: post-traumatic stress disorder, substance use disorder, and HIV-risk behavior. Where available, data from studies of the effects of Hurricane Katrina are included.*

**Keywords** adolescents; natural disaster; post-traumatic stress disorders; HIV; substance use

## Introduction

Fall 2005 proved to be one of the most devastating hurricane seasons in recent years for the Gulf Coast of the United States. Hurricane Katrina made landfall on August 29, 2005, ravaging communities in Louisiana, Mississippi, and Alabama; acutely impacting an estimated 700,000 people (Gabe, Falk, McCarty, and Mason, 2005). While the full consequences of Katrina and its aftermath (e.g., evacuation and relocation of residents and repopulation of the area), as well as possible exposure to a subsequent hurricane (Hurricane Rita) are still being assessed, adverse psychosocial outcomes can be anticipated among the area's youth. Not only are affected youth at risk for Post-Traumatic Stress Disorder (PTSD)

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and other psychological consequences of exposure to a natural disaster, but they may also engage in a variety of problem behaviors in response to this trauma, such as substance use and sexual risk behavior.<sup>1</sup> Thus, assessment and care of adolescent Gulf Coast hurricane survivors will have significant implications for their long-term physical and psychological well-being. In the years following Hurricane Katrina, it will also be important to understand the factors that may put exposed adolescents at increased risk for chronic psychological morbidity due to their trauma exposure.

The aim of this paper is to describe the current state of knowledge about the effects of hurricanes and similar natural disasters on adolescent psychological well-being, with a particular focus on psychological morbidity and negative health behaviors in the form of PTSD, substance use, and HIV-risk behavior. In reviewing these topics, we draw upon literature on the associations between trauma, PTSD, substance use disorders (SUD), and HIV-risk behaviors in adults when similar research on adolescents is unavailable. As data from studies discussing the effects of Hurricane Katrina on both affected adolescents and adults have become available, they have been included in order to provide some preliminary insight into the long-term effects of the disaster.

## Trauma Exposure

There is a large body of literature on exposure of adolescents to traumatic events, most of which focuses on interpersonal victimization (e.g., Ackerman, Newton, McPherson, Jones, and Dykman, 1998; Berton and Stabb, 1996; Ward, Flisher, Zissis, Muller, and Lombard, 2001). Epidemiological data indicate that adolescents are at high risk for experiencing traumas such as assault, rape, and robbery (Boney-McCoy and Finkelhor, 1995; Centers for Disease Control and Prevention [CDC], 2000). However, a few studies have provided information on the prevalence of lifetime exposure to another form of trauma among youth: natural disasters. For example, Giaconia et al. (1995) found a lifetime prevalence rate of approximately 2% for exposure to a natural disaster among a sample of 18-year-olds from a predominantly White, working-class community in the northeastern United States, while Breslau, Wilcox, Storr, Lucia, and Anthony (2004) reported a prevalence of 8.6% among a cohort of urban youth from a Mid-Atlantic U.S. state who were enrolled in the 1985–1986 school year and followed-up in 2000–2002. Costello, Erkanli, Fairbank, and Angold (2002) conducted a longitudinal general population survey of youth in western North Carolina and found that rates of lifetime exposure to a natural disaster were 1.9% for girls and 2.3% for boys.

## Post-Traumatic Stress Disorder

One potential outcome of exposure to traumatic events is the development of PTSD, a debilitating disorder that may have long-term consequences for adolescent survivors. PTSD

<sup>1</sup>The reader is reminded that the posited concept and process of *risk behaviors* and *being at risk* are often noted in the literature, without an adequate delineation of its dimensions (linear, nonlinear), its “demands,” the critical necessary conditions (endogenous as well as exogenous, micro to macro levels) which are necessary for it to operate (begin, continue, become anchored and integrate, change as de facto realities change, cease, etc.) or not to and whether its underpinnings are theory-driven, empirically based, individual and/or systemic stake holder bound, based upon “principles of faith.” The reader is referred to Hills’s criteria for causation which were developed in order to help assist researchers and clinicians determine if *risk factors* were **causes** of a particular disease or **outcomes** or **merely associated** (Hill, 1965). Editor’s note.

is an anxiety disorder of at least one-month duration that is characterized by symptoms of re-experiencing (e.g., intrusive memories or thoughts), avoidance and/or emotional numbing, and hyperarousal. It is often accompanied by feelings of anxiety and depression, social alienation, and mistrust of family, friends, and systems (Keane and Barlow, 2002).

The types of traumas that are most frequently linked to PTSD in adolescents are those involving interpersonal violence (Cuffe et al., 1998; Giaconia et al., 1995; Kessler, Sonnega, Bromet, Hughes, and Nelson, 1995). However, there is also evidence of psychological morbidity in the form of PTSD among adolescents exposed to natural disasters including bushfires (McFarlane, Plicansky, and Irwin, 1987), hurricanes (Garrison et al., 1995; La Greca and Prinstein, 2002; La Greca, Silverman, Vernberg, and Prinstein, 1996), and earthquakes (Asarnow et al., 1999).

### **Prevalence**

Rates of PTSD among adolescents and young adults have been provided across several large-scale community samples. For example, in the U.S. National Comorbidity Survey, 8% of 15–24 year old participants met lifetime criteria for PTSD (Kessler et al., 1995). In a nationally representative sample of U.S. youth aged 12–17 years, Kilpatrick et al. (2000) found that 5% of youth met criteria for a current diagnosis of PTSD. Of note, these rates do not reflect subthreshold yet clinically significant symptomatology experienced by some trauma-exposed youth.

In studies focusing specifically on natural disasters, PTSD has been identified as a common reaction in youth (Vernberg, La Greca, Silverman, and Prinstein, 1996). Using a random-digit dialing strategy to sample adolescents following Hurricane Andrew, Garrison et al. (1995) found that 3% of males and 9% of female adolescents met criteria for PTSD. Further, in a review of studies investigating rates of PTSD among youth exposed to devastating hurricanes (e.g., Hurricane Andrew in 1992 or Hurricane Hugo in 1989), La Greca and Prinstein (2002) reported that, across studies, approximately one-third to a half of youth reported moderate to severe PTSD symptoms.

Data emerging from the regions affected by Hurricane Katrina provide some information on PTSD prevalence among adults, though data on adolescents are still scarce. Data collected in the first weeks after Hurricane Katrina among adult evacuees in the Austin Convention Center suggest that 62% met the criteria for Acute Stress Disorder (ASD), which is likely to develop into PTSD over time (Mills, Edmondson, and Park, 2007). Also within weeks of the hurricane, Coker et al. (2006) surveyed adult evacuees in Houston shelters and found that a majority reported experiencing moderate to severe PTSD symptoms. Five to seven months after the hurricane, Galea et al. (2007) found PTSD rates of 16% among a sample adults living in Katrina-affected areas of Louisiana, Alabama, and Mississippi. When restricted to just those living in the New Orleans metropolitan area before the hurricane, the PTSD prevalence after the hurricane was 30%. A later study that reinterviewed a subsample of these individuals after one year found that PTSD prevalence increased significantly in those from all three states, but did not change significantly among the New Orleans subsample (Kessler et al., 2008).

Though data from Katrina-exposed adolescents are still scarce, one study that conducted pre- and post-hurricane surveys with 52 youth residing in New Orleans at the time of the hurricane found that PTSD scores assessed 17 months before the hurricane did not differ from PTSD scores six to seven months after the storm (Weems et al., 2007). Given the short amount of time that had elapsed between the disaster and these early prevalence

estimates, and the findings from studies conducted among adults revealing significant PTSD morbidity that appears to increase over time, it can be expected that PTSD will develop in a meaningful proportion of affected youth.

Moreover, research indicates that once PTSD develops in youth it may persist over time. La Greca and Prinstein's (2002) review indicated that some children exposed to hurricanes and earthquakes may exhibit symptoms up to one year after the event. Other investigators such as Shaw *et al.* (1995) found that Hurricane Andrew-exposed youth continued to report PTSD symptoms up to 32 weeks postdisaster. La Greca *et al.* (1996) examined post-traumatic stress symptoms in children at 3, 7, and 10 months after Hurricane Andrew and found that while there was a decline in symptoms over time, those who experienced moderate or severe levels of post-traumatic symptoms at the first assessment point continued to display symptoms for almost a year after the hurricane. In support of these observations, Kessler *et al.* (2008) conducted a one-year follow-up of Hurricane Katrina-exposed adults and found that 66.4% of those identified as having PTSD at baseline continued to have PTSD at follow-up, while 16.9% reported the presence of another mental disorder but no PTSD, and only 16.7% recovered.

Given the long-term morbidity that can be associated with PTSD among youth, in the aftermath of Hurricane Katrina we should expect that the psychological morbidity among adolescents will remain present over an extended period of time. Certain subgroups of adolescents may be at particularly elevated risk of developing morbidity and problem behaviors in response to this disaster. Youth exposed to several risk factors will have a greater chance of developing PTSD in the wake of Hurricane Katrina and may be at increased risk as they enter future hurricane seasons. These predictors of PTSD are discussed next.

### ***Predictors***

La Greca *et al.* (1996) and La Greca, Silverman, and Wasserstein (1998) have outlined an integrated conceptual model of predictors of children's postdisaster reactions that includes: 1) characteristics of the stressor (e.g., life threat and loss, or disruption), 2) characteristics of the child (demographics and predisaster functioning), 3) features of the postdisaster environment (level of support and occurrence of major life stressors), and 4) the child's efforts to cope with disaster-related distress. Over several studies, each of the proposed factors in this model has been shown to account for a unique portion of the variance in predicting post-traumatic stress symptoms in children (La Greca *et al.*, 1996; Vernberg *et al.*, 1996).

Some investigators have examined characteristics of the stressor such as the impact of the level of exposure (e.g., perceptions of life threat, number of life threatening experiences, and number of loss-disruption experiences resulting from the disaster) on post-traumatic stress reactions. Vernberg *et al.* (1996) found that perceived life threat, number of life-threatening experiences, and number of loss-disruption experiences were predictors of post-traumatic stress symptoms at three months after Hurricane Andrew in elementary school children (3rd, 4th, and 5th graders). In a subsequent evaluation of these same children at 7 and 10 months after the hurricane, La Greca *et al.* (1996) found that higher levels of PTSD symptoms were endorsed by children who perceived their life to have been threatened and who experienced more life-threatening events during the hurricane, and by those who continued to experience loss/disruption in their lives. At each time point, level of exposure accounted for a significant portion of the variance relative to the other predictors (La Greca *et al.*, 1996; La Greca *et al.*, 1998; Vernberg *et al.*, 1996). Similarly, in a small

sample of Hurricane Katrina-exposed adolescents surveyed six to seven months after the hurricane, the number of hurricane-related events was significantly associated with elevated post-Katrina PTSD scores (Weems et al., 2007).

Characteristics such as age, gender, and ethnicity have also been investigated as possible predictors of PTSD in youth. Age-related differences in PTSD symptoms following disasters have been observed in comparisons between youngsters of varying age cohorts (Green, Korol, Grace, and Vary, 1991; Nader, Pynoos, Fairbanks, and Frederick, 1990). La Greca and colleagues failed to find differences in PTSD symptoms following Hurricane Andrew, but this may have been due to the fact that they were studying this question among children within a narrower age range of 8–11 year olds (La Greca et al., 1996, 1998; Vernberg et al., 1996).

Female gender has consistently been associated with increased risk for PTSD, and a number of explanations for this gender difference have been offered (Olff, Langeland, Draijer, and Gersons, 2007). Several studies suggest that gender may be related to risk for post-traumatic stress symptoms among youth (Famularo, Fenton, Kinscherff, and Augustyn, 1996; Giaconia et al., 1995; Zink and McCain, 2003), although the data are mixed. For example, Shannon, Lonigan, Finch, and Taylor (1994) found higher levels of symptoms in girls than boys following Hurricane Hugo. Vernberg et al. (1996) also reported that girls experienced more distress at three months following Hurricane Andrew than did boys, although this difference did not persist at 7 or 10 months. In contrast, after controlling for level of exposure, La Greca et al. (1998) failed to find differences in post-traumatic stress responses based on gender among young children following Hurricane Andrew.

In a sample of youth residing in New Orleans at the time of Hurricane Katrina, female gender was significantly associated with elevated PTSD symptoms assessed six to seven months after the hurricane (Weems et al., 2007). Similarly, female gender has been associated with the presence and increasing severity of ASD among adult evacuees staying in the Austin Convention Center (Mills et al., 2007) as well as PTSD symptoms in a sample of adults from Louisiana, Mississippi, and Alabama (Galea et al., 2007). Coker et al. (2006), however, found no association between gender and PTSD symptoms scores among adult Katrina evacuees in Houston shelters.

The role of ethnicity in children's PTSD symptoms following a disaster has also been examined. Some studies suggest that minorities are at elevated risk for PTSD compared to other racial or ethnic groups (Garrison et al., 1995; Kilpatrick et al., 2003). There is evidence that this association will hold among youth as well. For example, Lonigan, Shannon, Finch, Daugherty, and Taylor (1991) found that African American youth reported more PTSD symptoms than either Caucasian children or other minority youth following Hurricane Hugo. Similarly, both Hispanic and African American children reported higher levels of PTSD symptoms than did Caucasian children at 7 and 10 months following Hurricane Andrew (La Greca et al., 1996; Vernberg et al., 1996). La Greca et al. (1998) also found that African American children reported more symptoms of post-traumatic stress than did children of other backgrounds following Hurricane Andrew, but this did not emerge until seven months after the hurricane. Race has been found to be associated with increasing severity of ASD among adult evacuees of Hurricane Katrina (Mills et al., 2007), but not with PTSD symptoms among adult evacuees in Houston shelters (Coker et al., 2006) or with post-Katrina PTSD symptoms in a small sample of adolescents (Weems et al., 2007).

Importantly, it has been noted that it is difficult to disentangle the apparent effects of race/ethnicity from the effects of socioeconomic status, race-related discrimination/stigma, and rural vs. urban environmental context (Alim, Charney, and Mellman, 2006); minority

families who are already financially compromised and/or who are more likely to reside in impoverished urban environments may be more adversely affected by the economic consequences of a hurricane (La Greca *et al.*, 1996). Thus, the possible role that race/ethnicity and socioeconomic factors play in the emergence of PTSD following a trauma clearly warrants further investigation.

A small number of studies have examined the predisposing influence of emotional and behavioral problems on post-traumatic stress reactions in children following various types of traumatic events. In a prospective study, La Greca *et al.* (1998) found that pre-existing anxiety levels predicted the severity of post-traumatic responses in youth with those showing higher levels of anxiety 15 months predisaster reporting higher levels of post-traumatic symptoms 3 and 7 months after the disaster. Children who exhibited higher levels of premorbid anxiety also appeared to be less likely to recover over time. Similarly, in a pilot investigation of 32 children and adolescents (ages 6–17), Earls, Smith, Reich, and Jung (1988) found that pre-existing psychiatric problems were related to post-traumatic stress symptoms one year after a severe flood. Among youth exposed to Hurricane Katrina, Weems *et al.* (2007) found that prehurricane trait anxiety was significantly associated with posthurricane PTSD symptoms, after controlling for baseline PTSD symptoms. In contrast, a small-scale study of 38 children (most 10–12 years of age) failed to find evidence for the role of premorbid psychiatric problems in reactions to witnessing a lightning strike that led to the death of a child (Dollinger, 1985).

Findings about premorbid behavioral functioning have also indicated a possible role for attention and academic difficulties in predicting postdisaster problems (Vogel and Vernberg, 1993). La Greca *et al.* (1998) found that children with attention problems and lower academic performance 15 months prior to Hurricane Andrew manifested higher levels of post-traumatic symptoms 3 months following the hurricane, but not at 7 months. These results emphasize the importance of longitudinal studies. In contrast to attention and academic performance, conduct problems did not predict postdisaster responses in this investigation.

There is also some evidence, based on studies with adults, that suggests a prior trauma history may affect the development of PTSD following subsequent trauma exposure. For example, in a series of studies with adult male and female war veterans, King, King, Foy, Keane, and Fairbank (1999) found that prewar trauma exposure increased the risk for developing PTSD following service in Vietnam. Thus, it may be important to investigate whether psychological responses to an earlier trauma influence the development of PTSD following Hurricane Katrina and whether exposure to Katrina will affect the development of PTSD following subsequent traumas. Additional pretrauma factors (e.g., socioeconomic status and family instability) have also been shown to exert indirect effects on the development of PTSD in adults through post-trauma recovery variables, e.g., availability of social support (King *et al.*, 1999). That is, individuals from a pretrauma disadvantaged environment may have insufficient resources to deal with the aftermath of the trauma and additional stressors. Not only will these findings regarding pre-existing psychosocial problems assist in the ongoing assessment and care of adolescents exposed to Hurricane Katrina, but they will also inform community response as the Gulf Coast enters future hurricane seasons and residents prepare for additional storms.

Among youth, evidence also suggests that certain elements of the postdisaster environment, including the functioning of significant others and access to supportive relationships, exposure to additional life stressors including physical relocation, and children's use of coping strategies may influence the emergence of PTSD (La Greca and Prinstein, 2002; La Greca *et al.*, 1996).

Vernberg et al. (1996) found that children with higher levels of social support from various sources including parents, teachers, and classmates reported fewer PTSD symptoms after Hurricane Andrew than those with less social support from these sources. Thus, support from particular sources may play a protective function. Parental reactions to a trauma such as a natural disaster may affect the likelihood that children will develop PTSD (Hamblen, 2006). Parents who are experiencing a high level of distress may not be able to serve important functions for their children in the postdisaster environment such as modeling, coping, and providing nurturance and a sense of physical safety (Vernberg et al., 1996), therefore providing assistance for affected parents, as well as their children, will be critical.

Additional environmental stressors and adversities often follow trauma and loss experiences (National Child Traumatic Stress Network, 2006). For Hurricane Katrina survivors this might include a lack of supplies, food, medications and shelter, a destabilization of routines, and a loss of community infrastructure. In addition, the physical displacement of thousands of individuals from their homes may be considered one of the most significant environmental stressors. Estimates of the number of individuals displaced by Hurricane Katrina range from 600,000 to 1.5 million. Over 265,000 applications for temporary housing payments and just under 12,000 temporary housing trailers had been provided as of October, 2005 (Gabe et al., 2005) and Red Cross evacuation centers provided shelter for over 500,000 individuals (American Red Cross, 2006). It has been argued that internal displacement (i.e., within one's own country) and residence in institutional postdisaster housing may elevate the risk for adverse psychological outcomes among refugees, though child/adolescent refugees may fare better than adults (Porter and Haslam, 2005).

Relocation was found to be associated with higher global depression scores among adult women 2½ years after a devastating earthquake in Armenia, though PTSD symptoms did not differ from women who did not relocate (Najarian, Goenjian, Pelcovitz, Mandel, and Najarian, 2001). Relocation to a different town after Hurricane Katrina was found to have a statistically significant association with increased prevalence of serious mental illness among adults living in three Katrina-affected states, however the magnitude of the increase was small (Kessler et al., 2008). In contrast, Najarian, Goenjian, Pelcovitz, Mandel, and Najarian (1996) found that children relocated after the Armenian earthquake did not fare worse than those children who remained in the earthquake city. Additional studies comparing the outcomes among adolescents who did and did not relocate after the hurricane will be required to understand the complex effects of this type of stressor. In the meantime, it can be expected that youth who have been relocated may at least require the same types of assessment and care provided to those who remained in hurricane-affected areas.

Exposure to new, major life events in the months following a disaster is also thought to be a significant contributor to postdisaster stress reactions among youth. La Greca et al. (1996) found that exposure to additional stressful life events predicted increments in PTSD symptoms in children over the year following Hurricane Andrew. While the mechanism remains unclear, the authors hypothesize that exposure to further life events may limit social support available to the child, or serve to magnify symptoms in an additive manner. Further, they suggest that additional work is needed to disentangle these subsequent life events from hurricane-related sequelae (e.g., death of a relative).

The data on coping responses following a natural disaster and their relationship to PTSD symptoms in youth is fairly limited. There is some evidence to suggest that self-reported coping and PTSD symptoms are strongly associated. Data indicate that this association is stronger for some types of coping than others. For example, La Greca et al. (1996) found that the use of certain negative strategies (i.e., blaming, angry responses) best predicted post-traumatic stress symptoms over time. In a study of family coping styles and psychological

functioning among adolescents exposed to Hurricane Katrina, Vigil and Geary (2008) found that exposed adolescents living in a relocation camp after displacement due to the hurricane reported significantly lower self-esteem and more symptoms of distress and depression than a sample of matched, nonexposed controls. They further found evidence that family mobilizing coping (i.e., seeking nonfamilial community-based support) partially mediated the association between hurricane exposure and these psychological symptoms. The authors conclude that some aspects of this particular type of coping style (i.e., seeking outside assistance) may make aspects of the trauma and the children's resultant vulnerability more explicit, may result in more frequent memories of the trauma, or may increase the children's perception of social stigma or demoralization.

Another type of coping that is common following a trauma, but that is maladaptive is substance use (Giaconia, Reinherz, Paradis, and Stashwick, 2003). The development of negative health behaviors such as substance use as a result of trauma exposure is of particular concern among adolescents because the formation of maladaptive behavioral patterns in adolescence may contribute to further psychosocial morbidity and to long-term chronic health problems in adulthood. Findings relevant to the relationship between trauma, PTSD, and substance use are discussed below.

### **Comorbidity of Trauma Exposure, PTSD, and SUD**

Several studies with adults have shown that trauma exposure increases the risk for alcohol and drug use (Kilpatrick, Acierno, Resnick, Saunders, and Best, 1997; Rheingold, Acierno, and Resnick, 2004; Stewart, 1996). PTSD has also been shown to increase the risk for problematic drinking and drug use among adult trauma survivors (Kessler et al., 1995; Kulka et al., 1990). Moreover, additional research indicates that PTSD may mediate the relationship between trauma exposure and severity of substance use problems (Epstein, Saunders, Kilpatrick, and Resnick, 1998). Among individuals with PTSD, the chronicity of PTSD symptoms has also been found to predict an increased risk for comorbid substance use problems beyond PTSD alone (Breslau and Davis, 1992).

Despite evidence that adolescents are at risk for trauma exposure, PTSD, and the development of a SUD (Giaconia et al., 2003), few studies have examined the relationship between these variables in this population. Limited data suggest that traumatized adolescents are likely to have high rates of substance use disorders (Giaconia et al., 2003). In a sample of German adolescents and young adults aged 14 to 24 years, a history of trauma exposure was linked to a lifetime SUD in 34.7% of participants (Perkonig, Kessler, Storz, and Wittchen, 2000). This rate exceeds lifetime rates of SUD found among adolescents in general community samples. Lewinsohn, Hops, Roberts, Seeley, and Andrews (1993) reported that approximately 11% of a community sample of youth in grades 9–12 met criteria for a SUD. Thus, while middle to late adolescence may be the peak risk period for the first onset of serious substance use problems (Burke, Burke, Rae, and Regier, 1991; Kessler et al., 1994) trauma exposure appears to increase this risk. These data suggest that exposure to a natural disaster such as Hurricane Katrina might put adolescents at risk for developing a SUD.

PTSD-Substance Use Disorder (PTSD-SUD) comorbidity has been documented among adolescents. In one community study of 18-year-olds, Giaconia et al. (2000) found that 3.6% of the total sample (or 8.5% of those exposed to traumas) met lifetime criteria for both a SUD and PTSD. Females in the study were at somewhat greater risk for this comorbidity than males (5.2% vs. 2.1%). In the previously cited study conducted by Perkonig et al. (2000), 5.3% of participants diagnosed with PTSD also had a SUD. Rates among clinical populations are generally higher, with one study of 11–18 year old inpatients finding

that 25% of those diagnosed with PTSD also had a current alcohol diagnosis (Lipschitz, Winegar, Hartnick, Foote, and Southwick, 1999). These findings suggest that survivors of Hurricane Katrina who develop PTSD may be at risk for developing a SUD.

Rates of trauma exposure and PTSD have also been examined in adolescents with a SUD. In Giaconia's et al. (2000) study of 18-year-olds, approximately 56% of participants with a SUD reported at least one lifetime trauma and 11% met criteria for lifetime PTSD. Further, across studies researchers have found that adolescents with a SUD are at heightened risk for experiencing any lifetime trauma (two- to five-fold) and for developing PTSD (four- to nine-fold) (Clark et al., 1997; Giaconia et al., 2000; Kilpatrick et al., 2000) compared to adolescents in the community without a SUD. Giaconia's et al. (2000) community study reported that even after controlling for cumulative lifetime exposure to trauma, adolescents with a SUD continued to be at greater risk (two-fold) for developing PTSD than their peers without a SUD. Risk for PTSD may also vary across drugs of abuse: four-fold for alcohol, six-fold for marijuana, and nine-fold for other drug abuse or dependence (Kilpatrick et al., 2000). Whether having a SUD might affect an adolescent's ability to cope with Hurricane Katrina and its aftermath or increase his or her participation in risky behaviors like hitchhiking, driving an automobile while under the influence, walking in unsafe neighborhoods (CDC, 2000; Windle, 1994) likely to result in additional trauma exposure and PTSD is unknown. However, it is clear that the association between trauma, SUD, and PTSD is likely to become evident among exposed youth, and that the potential for the further development of maladaptive coping strategies such as substance use is cause for concern among this population.

### ***Functional Impairment Associated with PTSD-SUD***

The impact of comorbid PTSD-SUD on adolescent psychosocial functioning has not been widely researched. In one of the only studies to examine psychosocial difficulties linked to PTSD-SUD in adolescents, Giaconia et al. (2000) found that comorbid PTSD-SUD was associated with a wide range of impairments. Similar to adolescents with a SUD only, those with PTSD-SUD showed externalizing behavior problems, poor school performance, likelihood of arrest, and suicidal behavior. In addition, those with PTSD-SUD showed a number of internalizing behavior problems, such as anxiety and withdrawn behavior, which are characteristic of youth with PTSD. Compounding these difficulties were communication problems, poor health perceptions, and somatic complaints. If left untreated, this comorbidity is likely to have an adverse impact on psychosocial functioning (Giaconia et al., 2003).

### ***Patterns of Onset of PTSD-SUD Comorbidity***

Recent studies indicate that there are multiple pathways leading to PTSD-SUD comorbidity in adolescents. Investigators have found that for at least some adolescents the onset of SUD followed the onset of trauma (25%–76%) and occurred after the onset of PTSD (14%–59%; Clark et al., 1997; Deykin and Buka, 1997; Giaconia et al., 2000; Perkonig et al., 2000). For other adolescents the onset of SUD appears to precede the onset of trauma (45%–66%) and PTSD (50%–75%; Giaconia et al., 2000; Perkonig et al.). Perkonig et al. also found that patterns of onset varied by SUD; alcohol use disorders preceded trauma in 45% and PTSD in 56% of participants, drug use disorders preceded trauma in 66% and PTSD in 75% of participants. Significant gender differences in onset patterns have also been noted. Women have been shown to be more likely to have a primary onset of PTSD prior to developing a SUD than males (Deykin and Buka, 1997). Thus, for some survivors of Hurricane Katrina, this experience may result in the development of a SUD, especially if PTSD develops.

### ***Mechanism of Action***

Among both adults and adolescents, multiple hypotheses have been presented to explain the association between trauma, PTSD, and substance use (Brady, Killeen, Brewerton, and Lucerini, 2000). First, substance use may represent an attempt to self-medicate symptoms related to the trauma, including PTSD (Brown and Wolfe, 1994; Ruzek, Polusny, and Abueg, 1998). Second, substance use may increase the likelihood of developing PTSD by interfering with an individual's ability to cope effectively with the trauma (Brown and Wolfe, 1994). Third, the presence of a SUD may increase the risk for exposure to traumas, for example when adolescents place themselves in a risky environment where they are likely to experience interpersonal violence (Cottler, Compton, Mager, Spitznagel, and Janca, 1992; Giaconia *et al.*, 2000). Thus, even if substance use begins as a method of coping with a prior trauma, it may contribute to retraumatization. While in the case of Hurricane Katrina it may not be reasonable to assume that pre-existing SUD contributed to trauma exposure (though it could have some effect on the *level* of exposure), it is reasonable to infer that youth with SUD may have impaired coping abilities, thereby increasing their risk of adverse outcomes postdisaster, or that youth may increase the frequency or intensity of their substance use in an effort to self-medicate and may thereby become more vulnerable to subsequent traumas.

### **Intersection of Trauma, PTSD, Substance Use, and HIV Risk**

Another negative health behavior that has been associated with both trauma exposure and PTSD is HIV risk behavior, either in the form of risky sex or drug use. This relationship has been studied in adults, however fewer studies have examined it among adolescents. Retrospective studies have documented high rates of victimization and other types of trauma among adults living with HIV. There is also growing evidence that PTSD is prevalent among individuals living with HIV (Brief *et al.*, 2004). Further, data indicate that trauma exposure and/or PTSD may increase an individual's risk for becoming infected with HIV. For example, Zierler *et al.* (1991) found that college-aged men with a history of sexual abuse had a two-fold increase in the prevalence of HIV infection relative to men who had not been abused, regardless of their sexual preference. In one study with adolescents enrolled in substance abuse treatment, those with acute Traumatic Stress symptoms reported having more frequent sex than those with fewer symptoms, though no differences were found in the use of barrier protection or number of partners (Stevens, Murphy, and McKnight, 2003). In another study, adolescent females with PTSD were twice as likely as controls to have a sexually transmitted infection and 60% more likely to have cervical dysplasia (Seng, Graham-Bermann, Clark, McCarthy, and Ronis, 2005).

There are several mechanisms through which trauma exposure might increase risk for HIV in adolescent trauma victims, particularly in the context of PTSD or PTSD-SUD. First, there is evidence of an association between trauma exposure (Johnsen and Harlow, 1996; Lodico and DiClemente, 1994), early onset PTSD (Stiffman, Doré, Earls, and Cunningham, 1992) and involvement in high-risk drug use behaviors for some types of trauma survivors (e.g., sexual abuse). Survivors of early childhood abuse show higher rates of using drugs that are likely to be injected (Johnsen and Harlow, 1996), an earlier initiation of injection drug use (Holmes, 1997), and a higher incidence of needle sharing (Lodico and DiClemente, 1994). The higher incidence of needle use is of particular concern, as sharing contaminated needles is a primary or secondary risk factor in a large proportion of HIV infections nationwide: 17% of new HIV diagnoses between 2001 and 2004 were among injection drug users (IDU) and 4% were among men who are IDU and have sex with men (CDC,

2005). A large proportion of new HIV infections among women are also attributable to IDU (21% compared to 16% among men; CDC, 2005). In the early days after Hurricane Katrina, when the drug market was severely disrupted (Fox and Gibbons, 2005) and supplies of drugs and injection paraphernalia were scarce, HIV risk behaviors among drug users may have become more prevalent, though future studies will be needed to confirm this.

Studies with trauma survivors also find higher rates of participation in high-risk sexual activities that can lead to HIV infection, e.g., unprotected intercourse, high numbers of sexual partners, and sex with riskier partners (Rheingold et al., 2004). Trauma survivors who develop an alcohol or drug consumption-related problem even in the absence of IDU may also increase their risk for HIV through participating in high-risk sexual activities while intoxicated (CDC, 2005). Whether adolescent survivors of Hurricane Katrina will show increased participation in either high-risk drug or sexual behaviors, similar to survivors of sexual abuse, is unclear. However, it is known that prevention and surveillance systems in New Orleans were severely disrupted due to the hurricane (Robinson et al., 2008), and will take time to be repaired. Further research is needed to examine the unique HIV risks faced by Hurricane Katrina survivors, and to determine whether those who experienced some type of interpersonal violence in the aftermath of the hurricane are at greater risk for engaging in HIV-related drug and sexual behaviors.

### Implications for Hurricane Katrina-Exposed Adolescents

Several risk factors for PTSD are present among the adolescent population exposed to Hurricane Katrina. Many of the individuals who were affected by the hurricane experienced direct exposure to the hurricane and floodwaters, witnessed the injury or deaths of family members, or in the aftermath of the hurricane were directly exposed to violence or were confronted with corpses (Coker et al., 2006). Furthermore, many families were separated, had their homes destroyed, and were prohibited from returning to their home cities. Homes in affected areas that were not destroyed still suffered serious damage including water damage, mold, and other contaminants. In fact, some estimate that 1.2 million homes were damaged as a result of the combined forces of Hurricanes Katrina, Rita, and Wilma in 2005 (Nation's Building News, 2006), resulting in widespread displacement. Lack of instrumental (e.g., insurance, medical care, employment, and housing) and social resources (e.g., social support and adequate coping) may further impede the postdisaster recovery of adolescents and their families. Moreover, the duration of the upheaval created by the hurricane may be a significant factor in predicting the level of vulnerability to negative mental health outcomes. Early data among adult survivors of Hurricane Katrina suggest that ASD and PTSD symptoms have developed, and the available literature among adolescent disaster survivors suggest that similar outcomes will be reported among youth. Thus, rates of PTSD should be expected to be high among exposed youth, and symptoms may be sustained for some time after the hurricane.

It might also be expected that traumatized youth may initiate or intensify substance use as a means of coping with the emotions resulting from exposure to the hurricane. In 2005, before Hurricane Katrina, youth in New Orleans were less likely than a national sample to report past 30-day alcohol use, but were as likely as others to have used marijuana and cocaine in the past 30 days. In addition, in 2005 youth in New Orleans were more likely than the national sample to report lifetime use of heroin, ecstasy, steroids, and injection drugs. More research is needed, but it is possible that intensification of use and/or transitions from lower- to higher-risk drug use behaviors (e.g. initiation of injection) may be observed among youth as a result of their exposure to the trauma, especially among those who develop PTSD.

Exposure to Hurricane Katrina and the subsequent development of PTSD either alone or in combination with a SUD may lead to high-risk behavior patterns, including sexual risk-taking. Thus, adolescents exposed to Hurricane Katrina may be at elevated risk for numerous negative health outcomes, both in the immediate aftermath of the hurricane and in the long-term. Comprehensive care for adolescents exposed to Hurricane Katrina will require attention to additional trauma exposure in the aftermath of the hurricane, PTSD, and SUD, as well as high-risk behaviors. Without intervention, there is concern that an early pattern of poor self-care, established in many young trauma survivors, might persist into adulthood (Allers and Benjack, 1992). With attention to the provision of sensitive and widespread assessment and care of traumatized adolescents, however, communities and care providers will have the opportunity to make a lasting impact on the health and well-being of affected adolescents.

## RÉSUMÉ

### **La probabilité de la névrose traumatique (PTSD), d'utiliser des produits dopants, et de comportement de risque d'HIV parmi des adolescents exposés à l'ouragan Katrina**

Des résultats psychosociaux nuisibles peuvent être prévus parmi la jeunesse exposée à l'ouragan Katrina. Les adolescents sont particulièrement vulnérables aux conséquences de cette catastrophe naturelle et peuvent souffrir des conséquences durables sous forme de morbidité psychologique et de développement des comportements négatifs de santé. Nous faisons la critique la littérature existante sur les effets de l'exposition aux catastrophes naturelles et les traumatismes semblables sur la jeunesse et, où les données sur la jeunesse sont indisponibles, sur des adultes. L'effet des catastrophes naturelles est discuté en termes de risque pour trois résultats négatifs de santé qui sont de l'intérêt particulier dû à leur potentiel de causer la morbidité durable: la névrose traumatique (PTSD), des problèmes d'utilisation des produits dopants, et le comportement de risqué d'HIV. Là où disponibles, les données sur les effets de l'ouragan Katrina sont incluses.

## RESUMEN

### **El Potencial de Trastorno de Estrés Postraumático, El Uso de Substancias y El Comportamiento de Riesgo Para VIH Entre los Adolescentes Expuestos al Huracán Katrina**

Adversos resultados psicosociales pueden ser previstos entre los jóvenes expuestos al huracán Katrina. Los adolescentes son particularmente vulnerables a las consecuencias de este desastre natural y pueden sufrir consecuencias duraderas en la forma de morbilidad psicológica y el desarrollo de negativos comportamientos de salud debido a su exposición. Revisamos la literatura existente sobre los efectos de la exposición a los desastres naturales y otros traumas similares entre los jóvenes, y donde los datos sobre la juventud no estaban disponibles, nos fijamos en estos efectos entre los adultos. El efecto de los desastres naturales se discute en términos de riesgo de tres resultados negativos para la salud que son motivo de especial preocupación debido a su potencial para provocar a largo plazo la morbilidad: el trastorno de estrés postraumático, trastorno por uso de sustancias, y el comportamiento de riesgo para VIH. Los datos procedentes de estudios que están disponibles sobre los efectos del huracán Katrina están incluidos.

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## Glossary

**Hurricane Katrina:** A category five hurricane that struck the Gulf Coast of the U.S. during the last week of August, 2005. The storm caused devastating damage along a large swath of the southeastern United States, including Louisiana and Mississippi, and was responsible for over 1,800 deaths. An area of approximately 90,000 square miles was declared a Federal disaster area.

**Post-Traumatic Stress Disorder (PTSD):** An anxiety disorder of at least one-month duration that is characterized by symptoms of re-experiencing (e.g., intrusive memories or thoughts), avoidance and/or emotional numbing, and hyperarousal. It is often accompanied by feelings of anxiety and depression, social alienation, and mistrust of family, friends, and systems.

**Substance Use Disorder:** A term used in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) to refer to both dependence on and abuse of drugs.

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